

**TITLE OF THE INVENTION**

**IMPROVED FRAMING SYSTEM**

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

5 The invention relates to framing systems generally, and more particularly to light gauge framing systems.

**Discussion of the Background**

Light gauge framing, especially light gauge steel framing, is becoming an increasingly popular alternative to wood framing in both residential and 10 commercial construction. Structures built with light gauge framing, like other structures, must resist natural forces such as windstorms and earthquakes. "Shear elements" is the name given to elements of the structure that resist these forces. In light gauge framing, the shear elements are typically shear walls.

Shear walls are typically constructed by either 1) applying a strong panel 15 product such as plywood on the outside of a wall framed with light gauge elements, or 2) applying a tension strap to the outside of such a light gauge framed wall (as used herein, "framed wall" refers to a wall constructed with spaced-apart studs).

The requirement for a strong panel material such as plywood in the first method is undesirable because these panel materials cost more than alternative, lower 20 strength panel materials. The second method of applying tension straps to the outside of the framed wall is undesirable for at least two reasons. First, applying tension straps on the exterior (either the inward or outward facing side) of a framed

wall interferes with materials (e.g., drywall or plywood) placed over the straps. Second, installing the straps can be problematic. On the one hand, if the straps are installed before the wall is in place, the wall cannot be adjusted to account for on-site conditions. Alternatively, if the straps are installed after the wall is in place, 5 the straps are often simply screwed or tack-welded in place without being under tension. This results in a fairly large displacement before the straps have any effect, thereby decreasing the effectiveness of the straps.

What is needed is an improved method for constructing a light gauge shear wall that can be easily manufactured and installed in a structure and that does not 10 interfere with subsequently installed construction materials.

### SUMMARY

The present invention meets the aforementioned need to a great extent by providing a framed shear wall having a pair of crossed tension straps passing through the studs that make up the shear wall. The straps are preferably rods or 15 cables and are preferably attached to upstanding plates installed at the corners of the wall. In highly preferred embodiments, each of two straps is attached to an opposite side of the upstanding plate such that the straps do not interfere with each other (i.e., one strap does not cause a deflection in the other strap) where the straps cross. The straps preferably include threaded ends and the upstanding plates 20 preferably have threaded receptacles sized to accept the threaded ends of the straps such that the straps can be tensioned before and/or after installation.

In one embodiment of the invention, the upstanding plates are bolted through a bottom surface of the wall into a threaded anchor plate at floor level.

Preferably, the threaded anchor plate is welded to a top of a wall on a floor below. In highly preferred embodiments, the threaded plate is welded to the top of the wall on the floor below before the wall below is installed, and flooring materials (e.g., concrete) are installed around the threaded plate. In this way, a wall above such a 5 floor can be installed by simply bolting the wall to the threaded plate.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

A more complete appreciation of the invention and many of the attendant features and advantages thereof will be readily obtained as the same become better 10 understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Figure 1 is a perspective view of two connected shear wall according to a preferred embodiment of the invention.

Figure 2 is a side view of the shear walls of Figure 1.

15 Figure 3 is a perspective view of a corner interconnection between the shear walls of Figures 1 and 2.

Figure 4 is a perspective exploded view of the corner interconnection of Figure 3.

20 Figure 5 is a side view of a T plate of one of the corners of the walls of Figs 1-4.

Figure 6 is a bottom view of the T plate of Figure 5.

Figure 7 is a side view of the corner interconnection of Fig. 3.

## DETAILED DESCRIPTION

The present invention will be discussed with reference to preferred embodiments of light gauge framed shear walls. Specific details are set forth in order to provide a thorough understanding of the present invention. The preferred 5 embodiments discussed herein should not be understood to limit the invention. Furthermore, for ease of understanding, certain method steps are delineated as separate steps; however, these steps should not be construed as necessarily distinct nor order dependent in their performance.

Figure 1 is a perspective view and Figure 2 is a side view of two attached 10 shear walls 100 according to a preferred embodiment of the present invention. Each of the shear walls 100 comprises a plurality of vertically oriented, spaced-apart studs 110. Three studs 110 are ganged together at the sides of each of the walls 100 for added strength. The studs 110 are connected by a bottom channel 130 and a top channel 140. A hollow rectangular member 150 is installed on the 15 top face of the top channel 150 opposite the side of the channel 150 that accepts the studs 110.

Each of the walls 110 also includes two crossed rods 120 attached to upstanding plates 160 on opposite corners of the wall 100. The crossed rods 120 provide shear strength to the walls 100 and perform the function of the panel or 20 straps in conventional shear walls. The rods 120 pass through holes in each of the studs 110 such that the rods are positioned entirely in the interior of the walls 100 such that no portion of the rods 110 extend past either the front or rear faces of the studs 110 or channels 130, 140. This allows materials such as drywall or paneling to be attached to the walls 100 without interference from the rods 120.

A perspective view of an upper corner 101 and a lower corner 102 of the connected walls 100 of Figs. 1 and 2 is illustrated in Figure 3, and an exploded perspective view of these corners 101, 102 is illustrated in Figure 4. The upper corner 101 is reinforced by a T plate 160 formed by a base plate 162 and an upstanding plate 161. The base plate 162 of the T plate 160 is positioned in the channel 140. A face plate 170 is preferably welded to an interior face 110a of the innermost stud 110, with the upper surface 170 a of the face plate 170 welded to the upper surface 140a of the channel 140. The interior edge 161a of the upstanding plate 161 and the interior edge 162a of the base plate 162 are preferably welded to the face plate 170, with the base plate 162 also welded to the top surface 140a of the channel 140. The base plate 162 of the upper corner 101 is shown with a plurality of holes 163. These holes are not necessary when the T plate 160 is installed in an upper corner 101 (the holes 163 are necessary when the T plate 160 is used in a lower corner as will be discussed below) and thus may be omitted if desired. In preferred embodiments, the T plate 160 and the face plate 170 are welded in the corner 101 prior to installation and preferably at the factory.

The upstanding plate 161 of the T plate 160 also includes a block 164 with a female threaded hole 165 sized to accept a threaded end 121 of rod 120. Opposite ends of any rod 120 are threaded in the opposite directions (i.e., one end is right-hand threaded and the opposite end is left-hand threaded) and blocks 164 in corresponding corners are threaded to match the end 121 of the rods 120. This is done so that when the rod is rotated, the blocks 164 on opposite ends of the rod 120 are either drawn in to increase tension on the rod 120 or pushed outward to release tension on the rod 120 depending on the direction in which the rod 120 is

rotated. The blocks 164 are also preferably welded to the upstanding plate 160 in both the upper and lower corners 101, 102 prior to installation and more preferably at the factory.

5       A rectangular member 150 is preferably welded to the top of the upper channel 140. The rectangular member 150 provides increased rigidity to the top of upper channel 140, which is especially desirable where a floor such as a concrete floor will be cast in place on top of the lower wall 110. The rectangular member 150 is also preferably welded to the upper channel 140 prior to installation and preferably at the factory.

10       The upper and lower corners 101, 102 are separated by a rectangular spacer 180 with a width  $W_1$  sized to match a width  $W_2$  of the rectangular member 150. The height  $H$  of the spacer 180 is chosen to match a thickness of a floor to be installed between the walls 100. The floor may be any material, and is most often concrete. The spacer 180 is also preferably attached to rectangular member 150 prior to installation and preferably at the factory.

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      An anchor plate 132 is attached to the top of the spacer 180. A side view of the anchor plate 132 and a bottom view of the anchor plate 132 are shown in Figs. 5 and 6, respectively. The anchor plate 132 includes four holes 134. Threaded nuts 133 aligned with each of the holes 131 are welded to a bottom surface 132a of the anchor plate 132. The holes 134 and nuts 133 are positioned such that they can be fitted inside the spacer 180. The anchor plate 132 is preferably welded to the spacer 180 before the wall 100 is installed, and more preferably still at the factory. Thus, in preferred embodiments, the a wall 110 leaves the factory with a rectangular member 150 welded to the top of channel 140 and with a T plate 160

with block 164, a face plate 170, a spacer 180 and an anchor plate 132 all welded in the positions described above at each of the upper corners 101 at the factory.

The lower corner 102 of the wall 110 is also reinforced with a T plate 160 and a face plate 170 installed in the similar manner as the upper corner 101. That 5 is, the base plate 162 of the T plate 160 is welded to the upper interior surface 130a of the lower channel 130 and to the face plate 170, and the face plate 170 is welded to an inside face 110a of an interior corner stud 110 and the interior upper surface 130a of the channel 130. Like the lower corner 101, the T plate 160 and the face plate 170 are preferably welded prior to installation of the wall 100 and more 10 preferably at the factory. Unlike the T plate 160 in the upper corner 101, it is necessary for the T plate 160 in the lower corner 102 to have holes 163 formed in base plate 162. The lower channel 130 also has a plurality of holes 131 in positions corresponding to the holes 163 in the base plate 162.

The threaded ends 121 of the rods 120 are also preferably inserted into the 15 blocks 164 of the T plates 160 at the factory in both the upper corner 101 and the lower corner 102, although they are preferably not under tension. Alternatively, the rods 120 may be installed at the work site. Each of the interior studs 110 has two holes formed therein, one for each of the crossed rods 120 as shown in Fig. 1. The blocks 164 of T plates 160 are positioned on opposite sides of the upstanding 20 plates 161 on T plates on opposite sides of the wall 100. That is, the blocks 164 on the upper left hand and lower right hand corners of a wall 100 are on the same side of their respective upstanding plates 161, and the upper right hand and lower left hand corners of the same wall 100 have their blocks 164 on the opposite sides of upstanding plate 161 as shown in Figs. 3 and 4. In this fashion, the two rods 120

are in parallel spaced apart planes and do not cause any deflection in each other even though they are both within the interior of the wall 100.

With each of the walls 100 configured in the preferred manner described above, installation is greatly simplified. When walls 100 on a lower floor have 5 been installed, the spacers 180 and anchors 132 protrude above the rectangular member 150. Next, a floor is installed such that the top surface is at the height of the top of the anchor plate 132. When the floor is concrete, the concrete is simply screeded to the top of the anchor plate 132. Once the floor is installed, the walls corresponding to that floor are simply placed in the desired location and secured to 10 the anchor plates 132 with a plurality (4 are used in preferred embodiments) of bolts 166. As shown in Fig. 7, the bolts 166 extend through holes 163 in the base plate 162, the holes 131 in the lower channel 130, the holes 133 in the anchor plate 132, and into the threaded nuts 133. The rods 120 are then adjusted to the desired tension and the walls 100 are then ready for drywall or other desired finishing 15 materials. This allows for very fast construction as compared to other methods. In addition, the rods 120 are at tension and are contained within the interior of the walls 100 so as not to interfere with the installation of drywall, plywood or other materials attached to the exterior surfaces of the walls 100.

Those of skill in the art will recognize that it is not necessary for the anchor 20 plates 132 to be attached to walls on the floor below and that the anchor plates 132 can simply be attached to a floor below. Alternatively, the walls 100 may be attached to the floor without the use of anchor plates 132. For example, when the walls 100 are installed over wood flooring, screws may be used in place of the bolts 166. As another example, when the walls are installed over concrete floors,

anchor upstanding sill bolts may be cast in place in the concrete floor in positions such that they correspond to the holes 163 in the base plate 162 of T plate 160 and the walls 100 may be secured in place using nuts threaded onto the sill bolts.

It should also be noted that rods having turnbuckles are used rather than 5 threaded rods and threaded mating blocks in some embodiments of the invention. This allows the rods (or cables) to be fixedly attached to the corners of the wall and be tensioned through adjustment of the turnbuckle.

Obviously, numerous other modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be 10 understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.